
Catalogue Description	Advanced techniques for 3D animation and visual effects development; including 3D pre-visualization, match moving, dynamics, multi-pass rendering, and node based digital compositing.
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Objective	Explore advanced rendering and compositing techniques for 3D computer graphics. Develop 3D scenes from initial storyboard, to pre-visualization and footage capture, to completion. Learn how to set up scenes for post-production, including photorealistic materials and texturing, HDR image capture, radiosity and global illumination lighting techniques, and multi-pass rendering. Adapt to a linear floating-point image format and production workflow. Basic chroma-key and matte painting techniques for image plates, camera tracking and match moving, 2D plate making, 3D asset creation, and pipeline production techniques for effective asset management and efficient collaborative productions.
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Prerequisites	ITP 215
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Hours	4 hours
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Course Structure	<ul style="list-style-type: none">• There are eleven weekly assignments that build to a series of benchmarks for each phase of production. Details are listed in the Class Outline sections below, and on Blackboard.• Details and instructions for all projects, benchmarks, and assignments will be available on Blackboard.• The grading values for each assignment and benchmark are listed in the Grading section below• There will be a capstone Final Project due for presentation at the beginning of the Final Exam session.• The Final Exam will be conducted at the time dictated in the Schedule of Classes. Tuesday, December 12, 11am-1pm
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Textbook(s)	Blackboard Nuke Users Guide Autodesk Maya Documentation Resources online and at Lynda.com and knowledge.autodesk.com Adobe online resources where necessary for Photoshop and After Effects
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Grading	<p>Intro Project = 10 points Compositing Effects (1 of 6) = 10 points Compositing Effects (2 of 6) = 10 points Compositing Effects (3 of 6) = 10 points Compositing Effects (4 of 6) = 10 points Compositing Effects (5 of 6) = 10 points Compositing Effects (6 of 6, Finished as Midterm) = 40 points Final Project Progress Check (1 of 6, Storyboard) = 10 points Final Project Progress Check (2 of 6, Revision, Asset List, Schedule) = 10 points Final Project Progress Check (3 of 6) = 10 points Final Project Progress Check (4 of 6) = 10 points Final Project Progress Check (5 of 6) = 10 points Final Project Progress Check (6 of 6) = 10 points Final project = 60 points Final Exam = 50 points Attendance and Participation = 30 points Total = 300 points</p>																								
Grading Scale	<p>Letter grades will be assigned according to the following scale:</p> <table border="0"> <tr><td>93%+</td><td>A</td></tr> <tr><td>90-92%</td><td>A-</td></tr> <tr><td>87-89%</td><td>B+</td></tr> <tr><td>83-86%</td><td>B</td></tr> <tr><td>80-82%</td><td>B-</td></tr> <tr><td>77-79%</td><td>C+</td></tr> <tr><td>73-76%</td><td>C</td></tr> <tr><td>70-72%</td><td>C-</td></tr> <tr><td>69</td><td>D+</td></tr> <tr><td>67-68</td><td>D</td></tr> <tr><td>66</td><td>D-</td></tr> <tr><td>65 and below</td><td>F</td></tr> </table> <p>Half percentage points will be rounded up to the next whole percentage. So for instance, 89.5% is an A-, but 89.4% is a B+.</p>	93%+	A	90-92%	A-	87-89%	B+	83-86%	B	80-82%	B-	77-79%	C+	73-76%	C	70-72%	C-	69	D+	67-68	D	66	D-	65 and below	F
93%+	A																								
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73-76%	C																								
70-72%	C-																								
69	D+																								
67-68	D																								
66	D-																								
65 and below	F																								
Homework	<p>All homework will be submitted on Blackboard. Detailed instructions and resources for each assignment will be posted on Blackboard along. http://blackboard.usc.edu</p>																								
Policies	<p><i>Make-up policy for exams:</i> To make up for a missed exam, the student must provide a satisfactory reason (as determined by the instructor) along with proper documentation. Make-up exams are generally only offered in emergency situations.</p> <p>Before logging off a computer, students must ensure that they have saved any work to either a USB drive or a service such as Dropbox. Any work saved to the computer will be erased after restarting the computer. ITP is not responsible for any work lost.</p> <p>ITP offers Open Lab use for all students enrolled in ITP classes. These open labs are held beginning the second week of classes through the last week of classes. Hours are listed at: http://itp.usc.edu/labs/.</p>																								

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 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 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.

A Further Note on Plagiarism

NOTE: This is a custom blurb that I use in my classes.

You can remove this if you don’t want it.

In this class, all homework submissions will be compared with current, previous, and future students’ submissions using MOSS, which is a code plagiarism identification program. If your code significantly matches another student’s submission, you will be reported to SJACS with the recommended penalty of an F in the course.

It is okay to discuss solutions to specific problems with other students, but it is not okay to look through another student’s code. It does not matter if this code is online or from a student you know, it is cheating. Do not share your code with anyone else in this or a future section of the course, as allowing someone else to copy your code carries the same penalty as you copying the code yourself.

Course Outline

Week 1 – Introduction and Toolsets

Day 1

Introduction to the class and course syllabus
Brief history of compositing and visual effects

Day 2

Deconstructing digital images and the rendering process
Fundamental 3D and digital compositing principles
Comparing the Nuke and After Effects compositing engines
Pre-multiplied vs. non-pre-multiplied images

Reading

Reference Slides
Compositing Visual Effects - Chapters 1 and 2

Assignment/Project

Intro Project: Use the provided materials to generate a composite scene with animated layers attributes to enhance overall effect. Export to QuickTime in either the Sorensen 3 or H.264 codec. Due Week 2.

Week 2 – Photographic applications for 3D

Day 1

Deconstructing cameras and the photographic process
Camerawork fundamentals
Aspect ratios, standards, focus, and exposure principles

Day 2

Shooting and image processing for a background plate
Discuss perspective and depth cues
Setting up a background plate into a 3D scene

Reading

Reference Slides
Digital Lighting and Rendering - Chapters 1 and 2

Assignment/Project

Compositing Effects (1 of 6): Take a photo of an environment to serve as a background plate for a composite scene. Acquire 3D assets to be composited together with the environment. Setup project folder and Maya scene file. Import 2D and 3D assets appropriately. Setup the background plate and then reverse calculate camera settings and position for accurate perspective. Render the vehicle separate from the background plate and composite them together as a QuickTime file. Due Week 3.

Week 3 – Advanced photographic applications for 3D

Day 1

Texture gathering
Limitations of standard low-dynamic range images
Shooting and Processing High Dynamic Range Images

Day 2

Applications for HDRI in 3D

Reading

Reference Slides
Digital Lighting and Rendering - Chapters 3 - 5

Assignment

Compositing Effects (2 of 6): Reshoot environments or HDRI assets to support the photorealistic lighting of the scene. Fix any remaining perspective problems. Animate the 3D assets moving realistically in the scene. Re-render based on these changes and use the compositing program to export them as a QuickTime file. Due Week 4.

Week 4 – Compositing 3D with Live Action

Day 1

Setup and matching of 3D lighting to a background plate
Exporting multiple render passes and compositing for shadows
Image based lighting and reflections

Day 2

Realistic materials
Ideal specifications for diffuse texturing
Contrasting game asset texturing to cinematic asset texturing

Reading

Reference Slides
Digital Lighting & Rendering - Chapters 6 and 7

Assignment

Compositing Effects (3 of 6): Apply lighting and materials to scene. Incorporate necessary tools and lighting techniques to achieve desired photorealistic effect. Render the lit and animated scene into separate passes: a 3D objects only pass, a shadow pass for where the 3D objects cast shadows against the environment, and the raw background plate. Composite together into a QuickTime file. Due Week 5.

Week 5 – Multi-pass Rendering

Day 1

Using render layers to optimize multi-pass rendering
Multi layer compositing principles and techniques

Day 2

Comparing basic effects and layered composite workflows
Diffuse, color, shadows, reflections, and occlusion

Reading

Reference Slides
Digital Lighting & Rendering - Chapters 7 and 11

Assignment

Compositing Effects (4 of 6): Break down the 3D scene into the following distinct render layers: diffuse, color, background shadows, object shadows, specular highlights, reflections, occlusion, and background plate. Render the layers, and composite together into a QuickTime file. Due Week 6.

Week 6 – Advanced Multi-Pass Rendering

Day 1

Specialty layers and channels
Z-Depth vs. Luminance depth
Image bit depth, 8-bit vs. 16bit vs. floating point

Day 2

Object IDs and the power of custom render passes
Node based compositing principles and techniques

Color correction and post effects

Reading

Reference Slides

Compositing Visual Effect - Chapter 3 and 4

Assignment

Compositing Effects (5 of 6): Add depth, specific object ID, and specialty render layers to the scene. Render these layers and update the composite to make use of them. Use the depth channel to add depth of field and environment fog effects to the scene. Use additional layers to isolate, color correct, and apply post effects to distinct elements within the scene. Composite together into a QuickTime file. Due Week 7.

Week 7 – Film, Video, Matting, and Chroma Keying

Day 1

Deconstructing film, video, and digital video standards

Aspect ratios, file formats, and frame rates

Day 2

Types of mattes and matting techniques

Chroma Keying

Making and mattes for 2D elements vs. 3D elements

Rotoscoping and wire removal

Reading

Reference Slides

Compositing Visual Effect - Chapter 11

Assignment

Compositing Effects (6 of 6, Finished as Midterm): Shoot or acquire, and then prepare at least two (2) 2D film or video elements for incorporation into the composite scene.

Composite them into the scene along with at least one custom matte element (2D, 3D, rotoscoped, etc.) and when the composite is complete, export into a QuickTime movie.

Due as midterm Week 8.

Week 8 – Matting Techniques for Particle Systems

Day 1

In class review of Composite Effects Scenes (Review Midterms)

Fundamentals for dynamic motion and animation systems

Day 2

Setting up mattes as image sequences

Applying mattes to particle objects

Discuss and hand out instructions for Final Project. The Final Project is due at the start of the Final Exam Session. See details below.

Reading

Reference Slides

Compositing Visual Effect - Chapters 5 and 6

Assignment

Final Project Progress Check (1 of 6, Storyboard): Plan, choreograph, and storyboard a visual effects sequence composed of three shots, as detailed in the Final Project specifications. Due Week 9.

Week 9 – Production planning and management

Day 1

Organizing a production pipeline
Adapting agile:scrum framework to the 3D animation process
Identifying benchmarks / product backlog
Choreographing weekly sprints

Day 2

Managing project assets
Managing project assets and backlog completions across a production team
Advanced project folder management and file referencing

Reading

Reference Slides
Compositing Visual Effect - Chapter 7 and 8

Assignment

Final Project Progress Check (2 of 6, Revision, Asset List, Schedule): Revise storyboards. Create a detailed Asset List, documenting all 3D, 2D, shots, and effects as outlined in the Final Project specifications. From this, generate a shooting and shot completion schedule. Upon approval, this schedule will form the basis for the remaining progress checks. Due Week 10.

Week 10 – Dynamic Effects

Day 1

Intermediate dynamic motion and animation systems
Rigid body systems

Day 2

Simulating complex physical phenomenon
Managing complexity for efficient feedback

Reading

Reference Slides
Compositing Visual Effect - Chapter 9

Assignment

Final Project Progress Check (3 of 6): Benchmarks according to production schedule. Due Week 11.

Week 11 – Advanced hard-surface surface construction and texture layout

Day 1

Modeling for architecture and from reference
Modeling for dynamic geometry

Day 2

UV layout techniques
Manual vs. script driven object shattering and demolition
Hero vs. stunt collision object modeling

Reading

Reference Slides

Assignment

Final Project Progress Check (4 of 6): Benchmarks according to production schedule. Due Week 12.

Week 12 – Advanced organic surface construction

Day 1

Pipelines and production tools for ultra-high polygon modeling

Day 2

Texture baking and transfer maps
Normal mapping and detail modeling

Reading

Reference Slides

Assignment

Final Project Progress Check (5 of 6): Benchmarks according to production schedule. Due Week 13.

Week 13 – Advanced material techniques

Day 1

Creating complex textures and multi-texture materials
Advanced rendering and shading nodes

Day 2

Procedural textures
Renderer-specific and proprietary materials

Reading

Reference Slides

Assignment

Final Project Progress Check (6 of 6): Benchmarks according to production schedule. Due Week 14.

Week 14 – Special Topics (1 of 2)

Day 1

Guest lecturer to be determined
Special Topic subject to be determined

Day 2

Network and distributed rendering for multi-pass rendering

Reading

Reference Slides
Digital Lighting & Rendering - Chapter 12

Assignment

Complete the Final Project for viewing in class Week 15.

Week 15 – Special Topics (2 of 2)

Day 1

Guest lecturer to be determined
Special topic subject to be determined

Day 2

Critiques of Final Projects
Remaining time will be Final Exam Study Session

Reading

Reference Slides
See Blackboard for additional slides and assigned reading.

Assignment

Study for Final Exam

Final Exam – Tuesday, December 12, 11am-1pm, OHE 542

All students must attend Final Exam session!

Multiple choice, Bring pencil and eraser, No make-ups!

ITP 360 – Final Project

Create an effects sequence of no less than 15 seconds and containing three to five consecutive visual effects shots.

Due for presentation Week 15

Required Components:

The shots must incorporate each of the following:

- 3D assets
- 2D assets (images attached to geometric “cards” or particle “sprites”, animated textures, etc.)
- At least one seamlessly composited film or video asset
- At least one dynamic custom made dynamic visual effect (rigid bodies, particles, nucleus cloth, etc.)

Production Process:

Adhere to a project folder and implement a clean production workflow that includes the following techniques:

- Animation, camera, and lighting techniques necessary to complete each shot effectively
- High Dynamic Range Imagery for photorealistic lighting and reflection mapping
- Multi-pass rendering workflow to support advanced post and compositing
- Node-based or layer-based compositing tools as necessary to assemble the shots and rendered assets.
- Color correction and post tools as necessary to uniformly polish the final project

Assessment:

The Final project is worth 60 points.

Concept art and storyboards are due Week 9.

Storyboard revisions, asset lists, and production plans are due Week 10.

Progress checks are due each week leading up to the Final deadline.

The Final project will be graded based on:

- Fifteen Seconds, Rendered, Composited = 10 points
- 2D assets seamlessly integrated with 3D assets = 10 points
- Diffuse, Reflection, Shadow, and Specular Passes
 - All passes present = 10 points
 - Accurately utilized = 10 points
- Quality of the finished product:
 - Performance = 10 points
 - Visual quality = 10 points