

**Course Developer:** Kirt Witte, Professor, Savannah College of Art and Design

**Course Name:** High Dynamic Range Imaging

**Course Description:** High Dynamic Range Imaging (HDRi) emphasizes the integration of computer-generated objects or characters into real world video or film footage. High Dynamic Range Imaging seeks to develop and integrate photography, lighting, and rendering into various 3D and 2D software applications by utilizing digital images containing light information more accurately than traditional digital imaging means. Prerequisite: "Intro to Maya"

**Course Goals:** The following course goals articulate the general objectives and purpose of this course:  
Learn how to integrate HDR images into various professional 3D and compositing applications.  
Learn how to use tone mapping.  
Learn how to cubic and spherical imagery for use in HDR images and reflection maps.  
Learn how to generate entirely computer generated spherical HDR files.  
Learn how to dramatically increase the overall apparent quality level of lighting accuracy.  
Experience how to create/use their own HDR imagery using various photographic methods.  
Gain exposure to various cinematographers and photographers and how they influence the VFX industry today.

**Course Outcomes:** The following course outcomes indicate competencies and measurable skills that students develop as a result of completing this course:  
Demonstrate the creation of HDR images for use in 3D animations as well as for compositing CG characters or CG elements into live action video or film footage.  
Demonstrate how photography is used in various aspects of the VFX industry.  
Evaluate and problem solve whether or not HDR or "traditional lighting" methods should be used for a specific project.  
Explain how tone mapping, image-based lighting, and high dynamic range images are used in the VFX industry.

**Required Text(s):**

*The HDRI Handbook*, by Christian Bloch, 2007 (ISBN-10: 1933952059)

*High Dynamic Range Imaging: Acquisition, Display, and Image-Based Lighting*, by Erik Reinhard, 2005 (ISBN: 0125852630)

**Recommended Text(s):**

*mental ray for Maya, 3ds Max, and XSI*, by Boaz Livny (978-0-470-00854-6)

*Vue 6 Revealed*, by Richard Schrand (1-59863-347-3)

*National Geographic Photography Field Guide 2nd Edition : Secrets to Making Great Pictures* by Peter Burian, & Bob Caputo (ISBN: 079225676X)

*Digital Photography for Dummies*, Fourth Edition by Julie Adair King (ISBN: 0764516647)

*Photography for Dummies, Second Edition* by Russell Hart (ISBN: 0764541161)

*Digital Texturing and Painting*, by Owen Demers (0-7357-0918-1)

*Digital Lighting and Rendering*, by Jeremy Birn (1-56205-954-8)

**Required Materials:** Blank DVDs or CD-roms.  
External portable hard drive *strongly* recommended.  
Digital SLR camera *strongly* recommended. (6 megapixel minimum)

**Schedule of Classes:** Key events including assignments, projects due dates/exam dates:

Class 1: Intro to class, syllabus, HDRI: A brief history and overview

(What is this class all about? What type of assignments will be doing? What skills and techniques will I be learning? Will this class help me get a job? What is HDRI? Paul Debevec, Greg Ward, and Erik Reinhard – Who are they and why is that important? What are they doing now? Radiance files by Greg Ward. Where to find additional information and resources. The HDRI Handbook by Christian Bloch, IVRPA.org, Info Sheet assignment descriptions, Presentation assignment descriptions, photography testing assignment details. Looking at 32-bit files on 8-bit monitors, the 16-bit monitors are coming!)

Class 2: HDRi Process Overview & Photography discussion – 8-bit vs 16-bit vs 32-bits, What is in a byte and why do we care? What is the difference between a 12-bit RAW and a 14-bit RAW file? The overall process from start to finish. Generating <.hdr> Radiance files in Photoshop, PhotoMatix, HDRshop, and Picturenaut. The importance/convenience of batch processing. Basics of Photography: F-stops, Shutter Speed, ISO/ASA, lenses, SLR or not to SLR?

Class 3: Photography/Lighting /Camera/RAW discussion - Advanced Photography: Film vs digital, lens choices – what that really means. Wider or longer for panos? Controlling depth of field. Lighting: color temperature (Kelvin), Tungsten, Fluorescent, Daylight, mixed, unknown. Digital Grey Cards, color correction in camera, Custom White Balance, Calibration, Locking your White Balance, exposure, and focus.

Class 4: Tonemapping - (What is it? Why? Manual tonemapping in Photoshop. Tonemapping in Picturenaut, HDRshop, and Photomatix Pro. Bad examples (Flickr.com) vs Professional examples 32-bit to 16-bit conversion. Creating realistic background plates from spherical panoramas.)

Class 5: Shooting digital spherical and cubic environment - Assignment #1 Due – Critique (Equipment needed: Tripod, VR head, Camera – Head set up, lens setup <nodal point> Is it really that important?, Its all about the glass, number of shots <panoramic calculator>, fisheye vs rectilinear, importance of leveling, “fixing it in post”, standardizing your shooting methods, time constraint issues, location/weather/sun issues, multi-image panoramic photography, mirror lockup, shooting fast, cable release, parallax issues, lighting/lens flare issues, grey cards and white balancing, proper light metering, “down and dirty” light metering, “Sunny F16” Rule. Weather issues. Being organized with large amounts of shots per location. Which photo should I take first? Does it matter? Extra shots? What if I bump the camera? Heavy vs light weight VR heads. Metadata is your friend. Other high end systems: Panoscan and Spheron. Gigapixel panoramas, LIDAR Scanning, image-based modeling, and beyond.)

Class 6: HDRshop, Picturenaut, LightGen, Smart IBL and Maya – (HDRshop: Generating Radiance files, camera response curve calibration, panoramic transformations, 32-bit retouching <pre-CS3>: Picturenaut <what HDRshop wanted to be>, Radiance file creation, 32-bit histograms, do I really need a calibration curve for each scene? Tonemapping via “Adaptive Logarithmic” or “Photo Receptor Physiology” Dynamic Range values: Lightgen Plugin for HDRshop and Picturenaut – Faking Image-based lighting – MEL issues with Maya 2008 – Do I need the full resolution spherical HDR? SmartIBL – What is it and why is it so convenient? But wait, there’s more... Getting it all into Maya – *LightBitch*: IBL for Lightwave)

Class 7: Lecture on RealViz Stitcher and generating spherical HDRI files - Assignment #2 Due – (Fisheye Conversion via PTLens, PTgui Pro, Realviz Stitcher – Automatic and Manual stitching, templates, masking, Force Stitching, external blending/renderers, panoramic conversions, Optimizing for Quicktime and Flash output, setting/limiting default views and rotations. Autorotating, copyright, and additional tweaks. Can’t I just stitch it in Photoshop?)

Class 8: Creating all-cg 3D HDRI environments – Vue6 xStream – (A new landscape paradigm – A great day for all HDRI artists – It doesn't get any easier than this. Vue6 vs Vue6 xStream issues. Atmospheres, environments, oceans, time of day, leveling the virtual camera, rendering options and setting up for spherical HDRI rendering. Just save! Importing HDRs into Maya. Importing "real" HDRs into Vue6.)

Class 9: Final in-class presentations completed - Assignment #3 Due - All Info Sheets distributed

Class 10: Discussion of Assignments 4, & 5 (Final Project Concepts Due)

Class 11: Lecture on Adobe Lightroom – (Database driven, the five main areas <Library, Develop, Slideshow, Print, Web> file management and organization, color correction, chromatic aberration, cloning/healing/cropping, animated PDFs, metadata, presets, templates, keywording/stamping, flash and html websites, customizing Lightroom & batch processing. "DXO Optics Pro" can fix problems you didn't know you had)

Class 12: Implementing/preparing HDR files/data into Maya/Houdini/Renderman – (SmartIBL, being smart with your files and tools. Accuracy: Do I really need the full resolution 32-bit panorama? Reflection maps, Image-based lighting, color maps, & environment mapping)

Class 13: Troubelshooting HDR files in mental ray. (So many buttons, so little time. Render Globals, Rule #1 – Turn off default Lights, To Final Gather or NOT to Final Gather, sample rates, IBL node, default Radiance "exposure" in Photoshop effects mental ray, mapping types, Emit Light?, Emit Photons?, & Irradiance.)

Class 14: Assignment 4 Due – Critique

Class 15: HDR's for "Fine Art" – ( Polar panoramas and Flexify 2, extending "traditional" photography to a new level, panoramic transformations gone wild, "traditional" panoramic transformations, seeing/composing the world in a whole new way)

Class 16: In-class work session

Class 17: Industry discussion – (ILM: Transformers, Mission Impossible:3, Indiana Jones #4 )

Class 18: Industry discussion – (Future of HDR in Film, Broadcast, Gaming, & Photography, Autodesk Toxxik: The future of 32-bit compositing)

Class 19: In-class work/help session – Pre Critique

Class 20: Assignment 5 Due - Critique – Class post-mortem, where do I go from here?

### Grading Opportunities:

Your overall course grade will be computed according to the following breakdown:

Assignment	Weight
Assignment 1 / Photography tests & Tonemapping	20 percent
Assignment 2 / Creating HDR images using three methods <QTVR cubic, Chrome Sphere, and all 3D CGI Spherical HDR Panorama>	20 percent
Assignment 3 / Research paper / Info Sheet / Presentation	10 percent
Assignment 4/ 3D Lighting - Compositing Still Image and all-CG Still Image	20 percent
Assignment 5 / Final Animation (At least 30 seconds in duration)	30 percent

## **Helpful Resources and URLs:**

The HDRI Handbook: <http://www.hdri-handbook.com/book/index.html>

Smart IBL: <http://www.hdrlabs.com/sibl/index.html>

Picturenaut: <http://www.hdrlabs.com/picturenaut/index.html>

Panoramic Calculator: <http://www.hdrlabs.com/tools/panocalc.html>

International VR Photography Association: <http://ivrpa.org/>

Mondo list of VR related tools and Utilities: <http://ivrpa.org/vr/links>

Los Angeles Mental Ray Users Group: <http://www.lamrug.org/>

Kirt Witte's HDRI-related links: <http://employeepages.scad.edu/~kwitte/html/HDRI.html>

Kirt Witte's HDRI Information Sheet links:  
[http://employeepages.scad.edu/~kwitte/html/Info\\_Sheets.html](http://employeepages.scad.edu/~kwitte/html/Info_Sheets.html)

Paul Debevec's website: <http://www.debevec.org/>

HDRshop: <http://www.hdrshop.com/>

Greg Ward's website: <http://www.anywhere.com/gward/index.html>

Erik Reinhard's website: <http://www.cs.bris.ac.uk/~reinhard/>

Adobe Photoshop Lightroom: <http://www.adobe.com/products/photoshoplightroom/>

Realviz Stitcher: <http://stitcher.realviz.com/>

E-on Software Vue6: <http://www.vue6.com/>