



UNREAL
ENGINE

INTRODUCTION TO VIRTUAL PRODUCTION

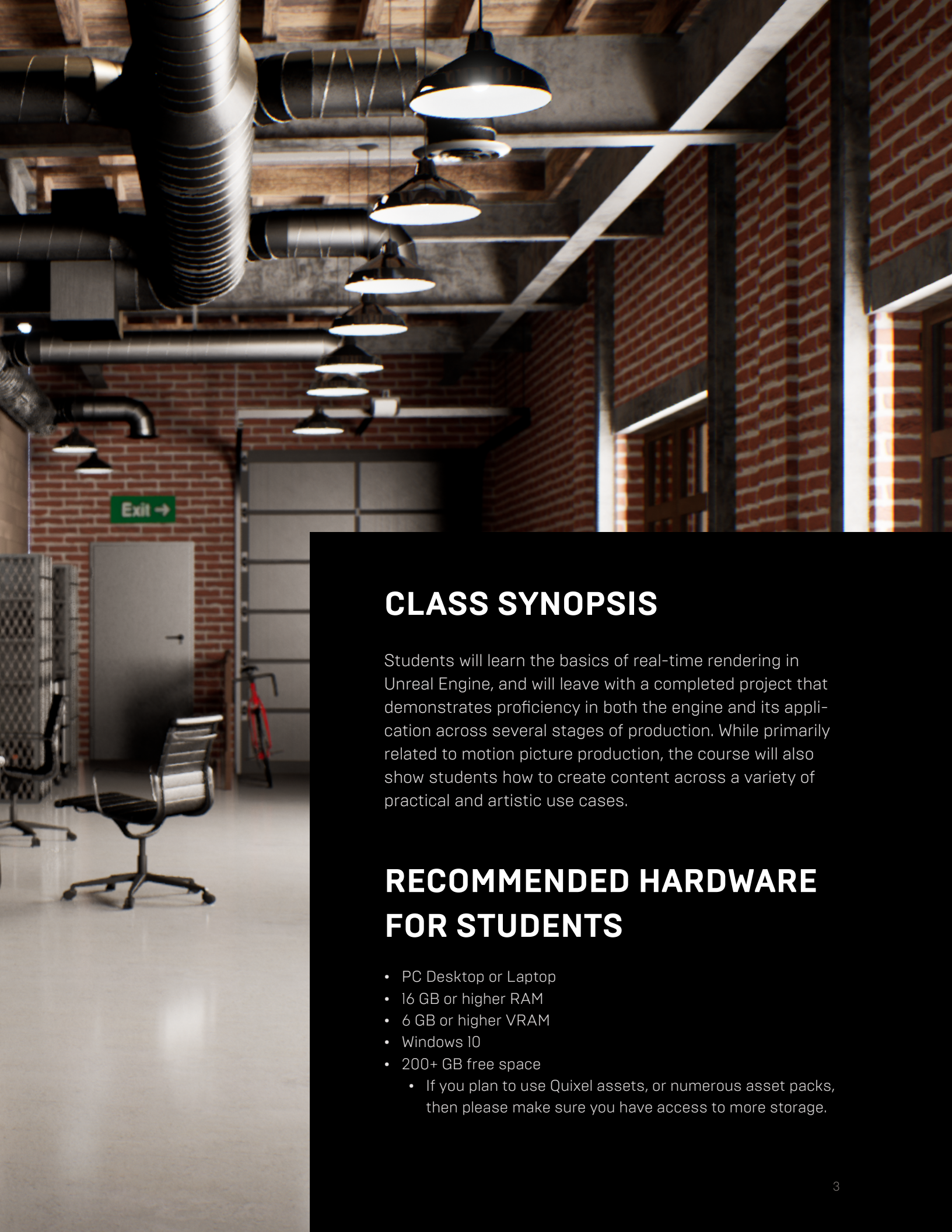


UNREAL ENGINE SYLLABUS



Deepak Chetty is a filmmaker, educator, and virtual production explorer. When he's not teaching real-time rendering, VFX, and interactive development at UT Austin, he acts as a Producer for Epic's Unreal Online Learning platform, working with industry authors to create training materials aimed at film, tv, and virtual production students.

As a filmmaker, Chetty is currently developing his first feature film, an adaptation of a Lumiere-award-winning short he wrote and directed called *Hard Reset*, which can be seen on Gunpowder and Sky's DUST platform. Chetty has also worked professionally as a cinematographer, with work appearing in festivals such as SXSW, Slamdance, Hamptons International, and AFI Silverdocs.



CLASS SYNOPSIS

Students will learn the basics of real-time rendering in Unreal Engine, and will leave with a completed project that demonstrates proficiency in both the engine and its application across several stages of production. While primarily related to motion picture production, the course will also show students how to create content across a variety of practical and artistic use cases.

RECOMMENDED HARDWARE FOR STUDENTS

- PC Desktop or Laptop
- 16 GB or higher RAM
- 6 GB or higher VRAM
- Windows 10
- 200+ GB free space
 - If you plan to use Quixel assets, or numerous asset packs, then please make sure you have access to more storage.

Courtesy of MARS Studios and Bild Studios



WEEK-BY-WEEK COURSE BREAKDOWN

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WEEK 01

- Course Summary
 - Introductions
 - Responsibilities
 - Syllabus Overview
- Unreal Engine Online Training
 - Create Epic Games account
- **Assignment 1: Watch Unreal Training Series**
 - **Upload screenshot with proof of completion**

WEEK 02

1st Session

- **Assignment 1 Due**
- Intro to Unreal Engine as a Cinematics Tool
 - Interface
 - Editor
 - Skeletal Mesh Editor
 - Static Mesh Editor
 - Materials Editor
 - Project Structure/Archiving
 - Marketplace
 - Object Manipulation/Importing Assets

2nd Session

- Introduction to Sequencer
 - Creating a Camera
 - Keyframe Animation Concepts
 - Timeline Editor
 - Graph Editor
 - Exporting Video/Images
 - High-Res Screenshot for:
 - Production Documents
 - Proxy Frames
 - Movie Render Queue for:
 - Motion Picture Exports
 - Still Image Exports
- **Assignment 1b: Create Artstation Account**

WEEK-BY-WEEK COURSE BREAKDOWN

WEEK 03

1st Session

- Intro to Unreal Engine as a Cinematics Tool (Continued)
 - The Cine Camera Actor
 - Physically Accurate Camera Settings
 - Overhead Diagram Creation Using Top View

2nd Session

- Lighting in Unreal Engine
 - Three-Point Lighting Demo
 - Movable vs. Static/Stationary
 - To Build or Not to Build?
- Environment Lighting Setup
 - Small Scale Interior
 - Large Scale Exterior
- **Assignment 2: Character Lighting Setup**

WEEK 04

1st Session

- Quiz 1: Unreal Engine Basics (Based off Assignment 1)
- Materials and Textures in Unreal Engine
- Material Instances and Editable Parameters
- Blueprint Basics
 - Hello World
 - Moving Actor (Non Keyframed)
 - Crowds
 - "Prefabs"
 - Characters
 - Rigs
 - Cameras
 - Lights
 - Actual Rigging
- **Assignment 2 Due - Review/Share**
- **Assignment 3: Material and Material Instance Creation**

WEEK-BY-WEEK COURSE BREAKDOWN

WEEK 04

2nd Session

- Character Creation Workflow
 - MetaHumans
 - Fuse
 - iClone
 - Daz3D

WEEK 05

1st Session

- Environment Creation in Unreal Engine
 - Simple Layout Techniques
 - Using Marketplace Assets
 - Environment Creation in Unreal Engine
 - Materials and Material Instances for cohesive Art Direction

2nd Session

- Environment Lighting in Unreal Engine
 - Refining Your Light in a Non-destructive and Iterative Way

WEEK 06

1st Session

- Deep Dive - Export Formats/Movie Render Queue
- DaVinci Resolve - Pipeline, Workflow, and Prep

2nd Session

- **Assignment 3 Due - Review/Share**
- Resolve Deep Dive (Continued)
 - LUT Creation/Ingest
 - Image Effects

WEEK-BY-WEEK COURSE BREAKDOWN

WEEK 07

1st Session

- **Assignment 4: Simple Scene Layout**
- Advanced Techniques in Unreal for Cinematics
- Physics Integration to Skeletal Meshes
 - Props
 - Ragdolls
 - Cloth
 - Groom
- Lighting
 - Volumetric Lighting
 - Optional: Ray-traced Lighting for Environments and Scalability/Performance Within Cinematics
- Post-Processing

2nd Session

- Post-Processing (Continued)
- Large-Format Rendering
 - Tiled Exports for Still Image Prints/Art Prints

WEEK 08

1st Session

- Using Megascans Assets
 - [Using Quixel Bridge](#)
 - Optimization/Integration

2nd Session

- [Intro to Quixel Mixer](#)
 - Material Creation
 - Material Instances
- Bridge/Mixer to UE workflow

WEEK-BY-WEEK COURSE BREAKDOWN

WEEK 09

1st Session

- **Assignment 4 Due - Review/Share**
- **Assignment 5: Existing Environment Re-Light**
- Concept Art Workflow
 - Layout/Lighting/Refining
 - Export
 - Touchup in Photoshop

2nd Session

- Facial Capture Workflow
 - [Live Link Face App Setup](#)
 - [Documentation](#)
 - Integration with MetaHumans
 - Integration with Daz3D
 - Capture
 - Facial Performance Editing
 - Combining Body and Face Performance Capture in Sequencer
 - Additive Animation Corrections in Sequencer
 - Refining Your Digital Performance
- **Assignment 5 Due - Review/Share**

WEEK 10

1st Session

- Advanced Concepts in Unreal
 - Advanced Physics Simulations/Destruction setup
- Advanced Concepts in Unreal
 - Physically Accurate Lighting with Manual Exposure
 - Using Real-World Light Values for Extremely Accurate Exposure
- **Assignment 6: Final Project Proposal**

2nd Session

- Advanced Sequencer Techniques
 - Master Sequence Workflow
 - Subsequence Techniques
 - Level Visibility Workflow
- Potential for Interactive Work using Blueprints for Automation

WEEK-BY-WEEK COURSE BREAKDOWN

WEEK 11

1st Session

- [Project Breakdown: Meerkat Demo](#)
 - Industry Best Practices for Organization
 - Migrating Assets

2nd Session

- Using the HDRI Sky Actor
 - HDRI Accuracy Demonstration
 - Creating Your Own HDRIs

WEEK 12

1st Session

- Post-Production Outside of Unreal
- Editing Workflow
- Sound Workflow

2nd Session

- Pre-production Material Creation

WEEK 13

1st Session

- Advanced Layout Techniques
 - Strategic Composition Techniques
 - Using Cards for Environment Simplification

2nd Session

- Abstract Creation in Unreal Engine Using Procedural Generation
 - Blueprint Creation
 - Material Creation
- **Assignment 7: Procedurally Generated Abstract Image or Video**

WEEK-BY-WEEK COURSE BREAKDOWN

WEEK 14

1st Session

- In-Class Work on Final Projects
- Virtual Production Demo/Lecture
 - Tracked Real World Camera Using HTC Vive Trackers

2nd Session

- **Assignment 7 Due - Review/Share**

WEEK 15

1st and 2nd Sessions

- In-Class Work on Final Projects
- Virtual Production Demo/Lecture
 - Live Mocap/Tracked Camera Demo with In-Camera VFX (Live Key)

WEEK 16

1st and 2nd Sessions

- In Class Work on Final Projects
- **Final Projects Due**
- **Final Project Reviews**

ASSIGNMENTS & PROJECTS

Assignment 1: Getting Started in Unreal Engine Learning Path

<https://www.unrealengine.com/en-US/onlinelearning-courses/getting-started-in-unreal-engine>

Assignment 2: Three Point Lighting Setup

Create a simple three point lighting setup inside of a black box environment for one character.

- Deliverables:
 - Render out a still image using either the High-Res Screenshot function, or the Movie Render Queue from four separate angles (no repeated framing) on the character.
 - Explain your methodology and lighting choices in the description of the stills on ArtStation.
 - Render out one keyframed camera movement as a video file. It must be at least 250 frames long.
 - Explain the choice behind your camera animation in the video description on ArtStation.
- Requirements:
 - The four Stills must be at least 1920 x 1080 in resolution and saved as a .png or .jpg file.
 - The video must be at least 1920 x 1080 in resolution and compressed as a .h264 file. Please upload it to Vimeo or YouTube and link it on your ArtStation account.
 - Submit the link to your ArtStation account.

Assignment 3: Material Creation

1. Create a brand-new material in Unreal Engine using an imported Texture. The texture may be any image you choose.
 2. Create a material instance from this material . The material instance must have parameter controls (i.e. roughness, specular, etc.)
- Deliverables:
 - Take a screenshot of your material in the Material Editor and post it to ArtStation
 - Take a screenshot of your material instance after double clicking on it and post it to ArtStation
 - Take a screenshot of your material or material instance on a Cube basic shape, placed into the viewport.
 - Requirements:
 - Submit the link to your ArtStation to turn this in.

ASSIGNMENTS & PROJECTS

Assignment 4 - Simple Layout

Use an asset pack (or your own assets) and create a simple interior or exterior environment. Add environmental and detail lights and render out at least four still images highlighting your work, attention to detail, and one animated camera move. Upload to your ArtStation page.

- Deliverables:
 - Render out a still image from four separate angles on the environment.
 - Explain your inspiration, methodology, and lighting choices in the stills description on ArtStation.
 - Render out one keyframed camera movement as a video file. It must be at least 250 frames long.
 - Explain the choice behind your camera animation in the video description on ArtStation.
- Requirements:
 - Turn in the link to your ArtStation page.
 - The four Stills must be at least 1920 x 1080 in resolution and saved as a .png or .jpg file.
 - The video must be at least 1920 x 1080 in resolution and compressed as a .h264 file. Please upload it to Vimeo or YouTube and link it on your ArtStation account.

Assignment 5 - Environment Re-Light

Use a level from *Permanently Free*, or an asset pack. *Do not change anything* in the level in regards to layout and composition. Remove all of the lights in the level. Re-light the level from scratch. Make it better! Make it your own!

- Deliverables:
 - Render out a still image from four separate angles on the re-lit environment.
 - Explain your methodology and lighting choices in the stills description on ArtStation.
 - Render out at least one comparison image, showcasing the differences between your version and the original version.
 - Render out one keyframed camera movement as a video file. It must be at least 250 frames long.
 - Explain the choice behind your camera animation in the video description on ArtStation.
- Requirements:
 - The four Stills must be at least 1920 x 1080 in resolution and saved as a .png or .jpg file.
 - The comparison still must be at least 1920 x 1080 in resolution and saved as a .png or .jpg file.
 - The video must be at least 1920 x 1080 in resolution and compressed as a .h264 file.
 - Please upload it to Vimeo or YouTube and link it on your ArtStation account.

ASSIGNMENTS & PROJECTS

Assignment 6: Final Project Proposal

Draft a one-page proposal detailing what you intend to do for your final project.

Assignment 7: Procedurally Generated Abstract Image or Video

Use Blueprint scripting and any material nodes of your choice to create an abstract, living composition. Physical accuracy does not exist here! Psychedelic patterns, a never ending loop of forward momentum in a retro-wave tron-esque landscape—anything is possible!

- Deliverables:
 - Render out a still image from four separate angles on the re-lit environment.
 - Explain your methodology and lighting choices in the stills description on ArtStation.
 - Render out on keyframed camera movement as a video file. It must be at least 250 frames long.
 - Explain the choice behind your camera animation in the video description on ArtStation.
- Requirements:
 - The four Stills must be at least 1920 x 1080 in resolution and saved as a .png or .jpg file.
 - The comparison still must be at least 1920 x 1080 in resolution and saved as a .png or .jpg file.
 - The video must be at least 1920 x 1080 in resolution and compressed as a .h264 file. Please upload it to Vimeo or YouTube and link it on your ArtStation account.

Final Project

OPTION 1

- Pre-visualize or fully animate a real-time rendered short film
 - Must be an original idea, or an adaptation of a work in the public domain
 - Method:
 1. Still images that are edited together to form an “animatic”
 2. Keyframe animated and edited together to form an in-motion previz
 3. Performance captured with Vicon camera (Studio 4A) or inertial system (Rokoko Smartsuit, Perception Neuron, DIY Vive Tracker IK setup)
 - Must be at least 60 seconds in duration (not including titles and credits)
 - May not exceed five minutes (including titles and credits)
 - May be traditional narrative or abstract
 - Must use Unreal Engine to virtually shoot and render the initial “footage” from your project:

ASSIGNMENTS & PROJECTS

1. Project may be edited in outside software (Premiere, Avid, FCP)
 2. Project may be color corrected, or have additional FX or image enhancement done in DaVinci Resolve/Fusion or After Effects, Nuke etc.
- Export/delivery settings (from AE or Media Encoder): 1920 x 1080 (4K maximum), H.264
 - Your finished file must be named as follows “LastName_FirstInitial_Realtime_FINAL” for example Chetty_D_Realtime_FINAL
 - **Please note:** Export/delivery settings and naming conventions in VFX workflows are incredibly important. Failure to submit your file with both the export settings correct and the naming convention correct will result in a loss of points.

OPTION 2

- Create a working shot/scene plan for a scene from your own original screenplay. This is a unified document that you would create as part of your pre-production materials. This is a well put-together PDF. Use Photoshop, make it look nice. Design it, choose good fonts. This is not a PowerPoint presentation.
 - Documentation must include:
 1. Overhead layouts of each camera setup and riggable equipment created in Unreal Engine using the High-Res Screenshot feature in Orthographic views for Elevation and Top-Down
 2. A corresponding shot list with physically accurate camera settings achieved inside of Unreal Engine
 3. Exported frames from each camera setup with relevant camera information baked in, to serve as a visual guide for framing, blocking and basic lighting
 4. Overhead lighting plan for each camera setup with riggable positions and physically accurate light values that correspond to real-world equipment
 5. A detailed equipment list that you are replicating virtually
 - Camera
 - Lenses
 - Lights
 - Speciality Rigging
 6. Physically Accurate Set Diagrams
 - Measurements are real-world and accurate
 - At least the following views delivered as separate “lit” images:
 - Four separate perspective views
 - One overhead
 - Two elevation
 - Front
 - Side

ASSIGNMENTS & PROJECTS

OPTION 3

- Use Unreal Engine to “previs” a scene from a pre-existing film by utilizing the film's original screenplay.
 - Choose a scene that is at minimum three pages long.
 - You must utilize the film's actual screenplay, not a transcript of the action.
 - You must include a .pdf to supplement your previz images or video animation or animatic with the following items:
 1. Overhead layouts of each camera setup
 2. A shot list with physically accurate camera settings
 3. Exported frames from each camera setup with relevant camera information
 4. Overhead lighting plan for each camera setup
 5. Equipment list
 - Camera/Lenses
 - Lights
 6. Physically Accurate Set Diagrams
 - Measurements are real-world and accurate
 - At least the following views:
 - Four separate perspective views
 - One overhead
 - Two elevation
- Then create a [choose one]:
 1. Previs animatic of the scene
 - Cut together still exports in external editing software
 - Timing/pacing matters!
 - Record audio for dialogue
 - Integrate SFX
 2. Create previz storyboards that you put together in a document, in order with any applicable notes.
 - This is not a slideshow, but a good looking production meeting ready document.
 3. Create a fully animated previz of the selected scene by combining this assignment option with option 1.

EPIC LEARNING CONTENT FOR VIRTUAL PRODUCTION

Sequencer	<ul style="list-style-type: none">• Your First Hour in Sequencer• Sequencer Training for Cinematic Shot Production
Physically Accurate Camera Settings	<ul style="list-style-type: none">• Physics Based Shotviz
Lighting in Unreal Engine	<ul style="list-style-type: none">• Lighting Essential Concepts and Effects
Materials	<ul style="list-style-type: none">• Unreal Editor Fundamentals - Materials
Blueprints	<ul style="list-style-type: none">• Blueprints - Essential Concepts
Materials and Instancing	<ul style="list-style-type: none">• Materials - Exploring Essential Concepts• Materials - Understanding the Production Workflow
Environment Lighting	<ul style="list-style-type: none">• Sky, Cloud and Environment lighting in 4.26
Movie Render Queue	<ul style="list-style-type: none">• Movie Render Queue Enhancements in 4.26
Volume Lighting	<ul style="list-style-type: none">• God Rays Using Volumetric Fog
Ray Tracing	<ul style="list-style-type: none">• Real-time Ray Tracing for Architectural Visualization• Achieving High Visual Fidelity with Ray Tracing• Capturing the Reality of Space with Ray Tracing

EPIC LEARNING CONTENT FOR VIRTUAL PRODUCTION

Post Processing	<ul style="list-style-type: none">• Post-Processing Essentials• Post-Processing and Cinematics
Quixel Bridge	<ul style="list-style-type: none">• Creating Photoreal Cinematics with Quixel
Quixel Mixer	<ul style="list-style-type: none">• Quixel Mixer Workflow and Applying Megascans in a Virtual World
Facial Capture	<ul style="list-style-type: none">• iPhone Facial Capture with Unreal Engine
Virtual Production with HTC Vive Trackers	<ul style="list-style-type: none">• Work-From-Home Virtual Production



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