FILM A234: 3D MODELING FOR IMMERSIVE APPLICATIONS

Item	Value
Curriculum Committee Approval Date	10/02/2024
Top Code	061410 - Multimedia
Units	3 Total Units
Hours	72 Total Hours (Lecture Hours 45; Lab Hours 27)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)

Course Description

While traditional 3d modeling and animation courses focus on fundamentals, several do not focus on the optimization and texturing aspects of 3d creation of content for platforms related to mobile technologies and AR/VR platforms. This class will not only cover basic fundamentals of 3D Modeling and Development, but the optimization pipelines and processes relevant to creating content that is suitable for integration into game engine software. Core concepts regarding model retopology, engine integration, texture creation, and basic model rigging for integration into a game engine will be covered. Industry pipeline development concepts for this type of optimized asset creation will be extensively covered in addition. This course is meant to be a 'primer', as a supplement to other Immersive Media courses. It will serve to enhance student's specific skillsets in the 3d modeling and texturing department specifically related to content suitable for immersive media applications. ADVISORY: FILM A220 or FILM A221; and FILM A223. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Discriminate between various optimization techniques used in Immersive Media (VR/AR) 3D content creation and video game design.
2. Demonstrate a basic level of proficiency in: a. 3d creation software b. optimizing models within the software for use in game engines specifically c. texturing, retopologizing, baking and rigging models through industry proven pipelines.
3. Evaluate and apply fundamental theoretical knowledge of industry-specific optimization challenges and techniques in 3D model creation and integration within game engines, demonstrating an understanding of how to address these issues to enhance performance and visual quality effectively.

Course Objectives

- I Showcase a general understanding of the optimization pipelines and processes related to 3D content development for immersive media applications.
- I. 1. Have fundamental knowledge of 3D Modeling software.
- I. 2. Optimize Models correctly through a variety of industry proven techniques within 3d modeling software.
- I. 3. Create optimized textures for 3d models using texture creation software.
- I. 4. Have a general understanding of poly count and engine limitations of poly count for 3d models
- I. 5. Integrate Optimized 3d Models into 3d game engine software.
- I. 6. Understand retopology techniques for 3d models.
- I. 7. Have a basic understanding of simple rigging and skinning of 3d models for animation purposes.
- I. 8. Create optimized 3d models from scratch within 3d modeling software or through plugins within game engine software.
- I. 9. Understand the limitations of game engine software related to performance on dedicated hardware and platforms.
- I. 10. Import 3d Models with animation into a game engine through industry pipeline methods.
- I. 11. Interact with 3d animated models using a game engine.
- I. 12. Understand the importance of Texture baking, and the various tools and software related to the process.
- I. 13. Understand how to UV-Unwrap a wide variety of 3d models for integration into game engines and texture applications.
- I. 14. Show an understanding of the importance of Draw Calls within a game engine as well as track performance of an optimized scene within a game engine software.

Lecture Content

I. Fundamentals of 3D Modeling A. Understand how to create and modify basic 3d polygons B. Overview of high poly sculpting vs. low poly sculpting and the differences between editors C. Common programs used for 3D content creation D. Basic Prop Creation in a 3D Creation Application E. Basic Character Creation in a 3D Creation Application F. Understanding Polycount. II. 3D Model Optimization and Surface Retopology A. How to optimize your 3D Modeling Pipeline B. Optimizing your Models for Low Poly Use in a VR/AR application C. Retopologizing a high poly model for low poly preparation D. Creating a successful retopology, common pitfalls E. Troubleshooting and checking your work III. UV-Unwrapping and Texture Baking A. An overview UV Unwrapping for 3D Models B. Understanding Planar Projections and U,V Coordinates C. Creating your first UV Unwrap D. Unfolding and Laying out UV Shells E. Preparing a Model for export to a 3D Painting / Texturing Application F. Creating an Ambient Occlusion Map through Texture Baking / Editing Initial Basic Color Textures G. Creating a Normal Map through Texture Baking / Editing Normal Maps H. Troubleshooting and checking your work III. Texturing Techniques A. Fundamental Texturing Techniques B. Mixing Layers to produce Effects when Texturing C. Creating your first Texture Map D. Exporting a Texture Map E. Material Set Up IV. Importing a Model into a Game Engine A. Material Set Up B. Analyzing a model's set up, Understanding 3D Model File Types C. Importing the model into the game engine D. Game Engine Model Set Up E . Assigning and refiining Models in Engine F. Understanding Level of Detail (LOD) and its importance in a game engine G. Deciding on LOD for your model H. Creating and LOD version of your model using retopology and general model editing techniques. V. Fundamental Rigging Concepts A. Creating a basic, "optimized" rigged character for mobile or VR/AR platforms B. Understanding skeletal joint /bone creation C. Skinning and Weighting a Model D. Editing Skin Weights of a 3D Model E. Creating a Controller

F. Creating a series of animations G. Exporting your 3D Character and Animations into a Game Engine H. Setting up Animations in a Game Engine VI. Explorations in Optimization A. Further exploration in optimizing models, and various alternative optimization methods and shortcuts B. Creating an Optimized Scene for a target framerate C. Analyzing various metrics within a game engine to view optimization efforts. D. Optimization Plugins and their uses E. LOD Setup

Lab Content

I. Using and Modifying Game Engine 3D Modeling Techniques II. Importing Models into a Game Engine III. Texturing Assignments IV. Texture Baking / Lighting Set Ups V. Retopology Techniques / Retopology Practice / Creating a Low Poly Surface Topology VI. Basic Rigging Exercises VII. Setting Up Models in Engine VIII. Creating an LOD Setup

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

1. Lecture 2. Demonstration 3. Video examples 4. One-on-one instruction 5. Individual assignments 6. Group assignments 7. Assignment critique 8. Examinations

Reading Assignments

Students will watch tutorial videos and lectures for about 1-2 Hours per week to assit with their own productions.

Writing Assignments

Students will spend 1-2 hours watching Tutorial Videos on a specific aspect of model optimization. Proficiency will be demonstrated by satisfactorily completing assignments and by incorporating the aspects of optimization methodology they have learned in there own projects. Students will demonstrate critical thinking and problem solving skills through the utilization of unique coding techniques relevant to Immersive Media, and by wthe creation of their own models, their implementation into a game engine, and the final result of their efforts.

Out-of-class Assignments

Students will spend 1-2 hours creating 3d models and texture mapping, or optimizing the models based on the assignments given.

Demonstration of Critical Thinking

A. Assigned individual projects B. Examinations

Required Writing, Problem Solving, Skills Demonstration

Students will create optimized 3d models pertaining to Game Engines and AR apps used in the creation of Immersive Media. Proficiency will be demonstrated by satisfactorily completing assignments and by incorporating the elements of instruction they have learned. Students will demonstrate critical thinking and problem solving skills through the utilization of industry proven pipeline techniques relevant to Immersive Media, and by working through optimization challenges as they arise.

Eligible Disciplines

Commercial art (sign making, lettering, packaging, rendering): Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience. Computer science: Master's degree in computer science or computer engineering OR bachelor's degree in either of the above AND master's degree in mathematics, cybernetics, business administration, accounting or engineering OR bachelor's degree in engineering AND master's degree in cybernetics, engineering mathematics, or business administration OR bachelor's degree in mathematics AND master's degree in cybernetics, engineering mathematics, or business administration OR bachelor's degree in any of the above AND a master's degree in information science, computer information systems, or information systems OR the equivalent. Note: Courses in the use of computer programs for application to a particular discipline may be classified, for the minimum qualification purposes, under the discipline of the application. Master's degree required. Multimedia: Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience.

Other Resources

1. Tutorial Videos on Game Engine websites and forums. 2. Existing Modeling and Texturing Projects pertaining to Immersive Media projects.