

ECE 412

Introduction to Computer Graphics: Scanline algorithms

Overview

Course Catalog Description: Introduction to computer graphics. Students will learn about 2-D and 3-D graphics, in particular as they relate to scanline rendering pipeline exposed by the OpenGL and DirectX APIs. Topics covered include image-based rendering, matting and compositing, the 3-D graphics pipeline, 2-D and 3-D transformations, rasterization algorithms, illumination and advanced real-time effects. The course concludes with a video game project built on the XNA platform that can play on an XBox 360 game console.

Prerequisites: ECE 331 or CS 361L

Textbooks: E. Angel, *Interactive Computer Graphics, a top-down approach using OpenGL*, 5th edition, Addison Wesley.

D. Shreiner, M. Woo, J. Neider, T. Davis, *The OpenGL Programming Guide: The Official Guide to Learning OpenGL*, 6th Edition, Addison-Wesley.

Class Goals: To build a solid foundation on the technical aspects of computer graphics. Students will exercise their programming abilities while learning about 2-D and 3-D graphics algorithms. Students will also apply their knowledge of linear algebra to the process of scanline rendering. By the end of the course, the students should have a basic, working knowledge of computer graphics techniques.

Course Coordinator: Prof. Pradeep Sen

Table I: Objectives, Implementation, and Assessment

Objectives		Implementation	Assessment	A	B	C	D	E	F	G	H	I	J	K
O ₁	Understand the fundamentals of computer graphics as implemented in the traditional 3-D graphics pipeline	12.5 hrs. lecture in weeks 5 to 10, homework assignments	HW 2-4, final project, midterm, final exam	X				X					X	X
O ₂	Understand the physics and mathematics used in computer graphics	6 hrs. lecture in weeks 2-4, homework assignments	HW 2-3, midterm, final exam	X				X						
O ₃	Understand basic linear algebra concepts and apply them to problems in computer graphics	9 hrs. lecture in weeks 6-9	HW2-3, final project, midterm, final exam	X				X						
O ₄	Understand how to structure medium-sized programs (> 5000 lines of code) in the process of writing graphics applications	Homework assignments	HW 3 and final project	X		X	X	X		X				X
O ₅	Gain experience implementing data structures and algorithms, and using these to solve practical engineering problems	5 hrs. lecture throughout the course	HW1-4, final project	X		X	X	X						X
O ₆	Understand advanced illumination effects that can be used in real-time applications	5 hrs. lectures in weeks 12-13, programming project assignments	HW4, final project, final exam	X			X	X					X	

ECE/CS 412 Course syllabus

Week	Date	Material	Notes
1	8/25 8/27	<ul style="list-style-type: none">• Introduction, overview of course, intro to computer graphics• Light, vision and color	
2	9/1 9/3	<ul style="list-style-type: none">• Labor Day Holiday (no class)• Sampling Theory I	HW 1 assigned
3	9/8 9/10	<ul style="list-style-type: none">• Sampling Theory II• Image-based graphics and computational photography	
4	9/15 9/17	<ul style="list-style-type: none">• Light fields and image formation• Matting	HW 1 due
5	9/22 9/24	<ul style="list-style-type: none">• 2-D graphics hardware and introduction to the 3-D graphics pipeline• Representation of geometry	HW 2 assigned
6	9/29 10/1	<ul style="list-style-type: none">• Representation of geometry• 2-D transformations	HW 2 due
7	10/6 10/8	<ul style="list-style-type: none">• 3-D transformations• Projection transformations	HW 3 assigned
8	10/13 10/15	<ul style="list-style-type: none">• Clipping and rasterization• Mid-term Exam	MIDTERM
9	10/20 10/22	<ul style="list-style-type: none">• Rasterization• Texture Mapping	
10	10/27 10/29	<ul style="list-style-type: none">• Texture Mapping and Graphics APIs• DirectX / Vertex and Fragment programs	FINAL PROJECT ASSIGNED
11	11/3 11/5	<ul style="list-style-type: none">• Final Project / XNA Framework• Lighting Models	HW 3 due
12	11/10 11/12	<ul style="list-style-type: none">• Lighting Models• Bump mapping, environment maps and reflection	HW 4 assigned
13	11/17 11/19	<ul style="list-style-type: none">• Shading effects• Shadows	
14	11/24 11/26	<ul style="list-style-type: none">• Graphics effects• Thanksgiving Holiday	HW 4 due
15	11/27 11/29	<ul style="list-style-type: none">• Animation• Animation	
16	12/1 12/3	<ul style="list-style-type: none">• Animation• Animation	
16	12/8 12/10 12/11	<ul style="list-style-type: none">• Final projects play testing• Development day• Video Game competition (public game play 9 – 5pm, presentations and awards 6 – 9pm)	
17	12/17	<ul style="list-style-type: none">• FINAL EXAM 10AM – noon	FINAL EXAM