

# CS 535 Intermediate Computer Graphics Fall 2004

## ***Time, Location***

The course meets MWF 01:00PM-01:50PM in RMB 323

## ***Introduction***

This course will focus on the theory behind the most important computer graphics paradigms. In particular, students will get hands on experience with 3D viewing, transformations, line rasterization, polygon rasterization, shading, texturing and advanced rendering. There will be 3 major programming assignments and a final exam. The lectures will be aimed at helping students accomplish the programming assignments and to learn the theory for the final exam.

## ***Professor***

### **Contact Info:**

David Nister

Center for Visualization and Virtual Environments

University of Kentucky

1 Quality Street, Suite 800

Lexington, KY 40507-1464, USA

Email: dnister at cs.uky.edu

Phone: +1-859-257-1257 ext 82205

Web: <http://www.vis.uky.edu/~dnister/>

Office: 237 Hardyman Building and 827 Kentucky Utilities Building

### **Office Hours:**

MWF 02:00PM - 04:00PM and by appointment

Location: CSLab or 237 Hardyman (which one will be announced in the class just before, any student wishing to have support in the CSLab or to demonstrate, should request it before class the same day).

## ***Course Materials, Content***

You are responsible for obtaining a copy of the required textbook (Hill) listed below.

The final exam will be on the whole book, but with focus on the sections listed in the schedule below and the material required to accomplish the programming assignments.

A few advanced topics will also be lectured from the reference text Foley, van Dam, Feiner and Hughes. Lecture notes on these topics will also be provided. (the readings of these sections are marked "Notes,fvd<section nr>" in the schedule below.

The webpage <http://www.vis.uky.edu/~dnister/Teaching/CS535/cs535.html> will be the primary method of distributing information for the course.

### **Required Text:**

F.S. Hill, jr, **Computer Graphics using OpenGL, 2nd Edition,**

Prentice Hall, ISBN: 0-02-354856-8

## Reference Texts:

J. D. Foley, A. van Dam, S. K. Feiner, and J. F. Hughes, **Computer Graphics: principles and Practice, 2nd Edition in C**, Addison-Wesley, Reading, Mass., 1996

M. Woo, J. Neider, and T. Davis, **OpenGL: Programming Guide, 2nd Edition**, Addison-Wesley, ISBN no: 0-201-46138-2.

## ***Programming Assignments***

There will be 3 programming assignments. Detailed instructions for each assignment will be made available on the web page. The programming assignments are to be completed by each student independently. You may discuss ideas with others, but no sharing of computer code will be allowed. The University of Kentucky's guidelines regarding academic dishonesty will be strictly enforced. All relevant sources should be cited in the code descriptions.

C or C++ should be used for all three programming assignments. In all three programming assignments, Open GL should be used to obtain a window, clear the window, perform double buffering and get mouse input. However, all drawing should be accomplished **without** OpenGL. That is, either open GL should **only** be called to draw individual pixels one at a time, or the pixmap should be created in memory with your program without calling OpenGL, and the pixmap put in the screen buffers with a single OpenGL call. The CSLab will be used for the programming assignments.

See <http://www.cslab.uky.edu/> for more details on the CSLab.

You are free to develop the code anywhere, but the final code should run and be demonstrated in the CSLab.

## **Submissions and Deadlines**

The programming assignments should be demonstrated in the CSLab before or on the due date. The code, along with a one page description in pdf, and preferably a screen-shot all zipped into one file, should then be electronically submitted to [dnister at cs.uky.edu](mailto:dnister@cs.uky.edu) on or before the due-date. The email should have "CS535-<Your name>" as the title. Any student wishing to have support in the CSLab or to demonstrate, should request it before class the same day. Late submissions will incur a 10% deduction. Submissions more than one week late will incur a 50% deduction.

## ***Grading and Assignment Policies***

The grade in CS535 will be determined according to these weights:

Programming Assignments	50%
Final Exam	40%
Participation	10%

## ***Central Educational Objectives***

- 3D Viewing, Transformations, Line Rasterization
- Polygon Rasterization, Shading and Texturing
- Advanced Rendering, Ray-Tracing
- Curve and Surface Modeling

Week	Date	CS 535 Syllabus Fall 2004	Readings
1			
	Wed 8/25	Introduction, Raster Displays, Vector Displays	1
	Fri 8/27	Overview of the Rendering Pipeline	2-2.1.3
2	Mon 8/30	<i>Description of Assignment 1</i>	2
	Wed 9/1	Open GL, General	3
	Fri 9/3	Open GL, Double Buffering, Interface devices	2.4-2.5
3	Mon 9/6	<b>Academic Holiday: Labor Day (No Class)</b>	
	Wed 9/8	Lines for filling, The Midpoint and Bresenham's algorithm	3.3,10.4
	Fri 9/10	Dot Prod., Vector Prod., Homogeneous. Coord.	4.1-4.5, App. 2
4	Mon 9/13	Transformations I	5.1-5.4
	Wed 9/15	Transformations II	5.5-5.7
	Fri 9/17	3D Viewing I 3,7	3.1-3.2,7-7.4
5	Mon 9/20	3D Viewing II 3,7	7.5-7.7
	Wed 9/22	<i>Discussion of Assignment 1</i>	
	Fri 9/24	<i>Description of Assignment 2</i>	
6	Mon 9/27	z-Buffering	8.4,13.1-13.3
	Wed 9/29	Triangle Rasterization ( <b>Assignment 1 Due</b> )	13.4
	Fri 10/1	<b>Academic Holiday: Fall Break (No Class)</b>	
7	Mon 10/4	Triangle Texturing	8.5-8.7
	Wed 10/6	Shading, Flat Shading, Goraud Shading	8-8.3
	Fri 10/8	Phong Shading	8.3
8	Mon 10/11	Environment mapping	Notes, fvd 16.6
	Wed 10/13	Bump mapping	8.5.3
	Fri 10/15	Cook-Torrance, Torrance-Sparrow Shading	14.7.3
9	Mon 10/18	<i>Discussion of Assignment 2</i>	
	Wed 10/20	<i>Description of Assignment 3</i>	
	Fri 10/22	Ray Tracing I, Visible Surface Determination	14-14.3
10	Mon 10/25	Ray Tracing II, Spheres, Planes, Cubes ( <b>Assignment 2 Due</b> )	14.4-14.6
	Wed 10/27	Ray Tracing III, Shading, Reflection, Recursion	14.7-14.9
	Fri 10/29	Ray Tracing IV, Shadows, Transparency	14.10-14.11
11	Mon 11/1	Ray Tracing V, Adaptive Supersampling	Notes, fvd 15.10.4
	Wed 11/3	<i>Discussion of Assignment 3</i>	14.12-14.13
	Fri 11/5	The Rendering Equation	Notes, fvd 16.11
12	Mon 11/8	Radiosity	Notes, fvd 16.13
	Wed 11/10	Color Theory	12
	Fri 11/12	Pixmap, Antialiasing	10.1-10.3,10.8
13	Mon 11/15	Using Open GL	2.2.6
	Wed 11/17	Pick Correlation	Notes
	Fri 11/19	Modeling, Geometric, Physical, Topological, Functional	6
14	Mon 11/22	Modeling with meshes	6
	Wed 11/24	Transformation Hierarchies ( <b>Assignment 3 Due</b> )	Notes , fvd 7
	Fri 11/26	<b>Academic Holiday: Thanksgiving (No Class)</b>	
15	Mon 11/29	Hermite, Bezier	11.1-11.5
	Wed 12/1	Bezier, B-spline	11.6-11.8
	Fri 12/3	Rational B-splines, NURBS	11.9-11.10
16	Mon 12/6	Surfaces	11.11
	Wed 12/8	Animation, Key-framing, Quaternions	Notes
	Fri 12/10	Fractals, Chaos	9
Final	Fri 12/17	<b>(1:00PM-3:00PM) Final Exam</b>	