CIS 636: Introduction to Computer Graphics
Spring 2011

Hours: 3 hours; 3 hour extended course project option (CIS 598, 690, 798, 890) available
Prerequisite: CIS 300 and knowledge of C/C++ programming. Background in **precalculus (trigonometry and analytic geometry) and basic matrix algebra (Math 551)** recommended. A first course in computer graphics is *not* required for CIS 636, but is recommended for CIS 736.
Textbook: Eberly, D. H. (2006). *3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, 2nd edition.* San Francisco, CA: Morgan Kaufmann. ISBN: 0122290631
Venue: MWF 10:30 – 11:20, Room 127 Nichols Hall (Lecture) and Room 128 Nichols Hall (Lab)
Instructor: William H. Hsu, Department of Computing and Information Sciences
Office: 213 Nichols Hall URL: http://www.cis.ksu.edu/~bhsu E-mail: bhsu@ksu.edu
Phone (Google Voice: office/home/cell): +1 785 236 8247 TA: Ming Yang, 218 Nichols Hall
Instructional e-mail alias (use for instructor and TA): CIS736TA-L@listserv.ksu.edu
Office hours: 12:30 – 13:30 Monday, Friday; 09:00 – 10:00 Wednesday; 09:30 – 10:30 Tuesday; by appointment
K-State Online (KSOL) page: http://bit.ly/hGvXlH
Course web page: http://www.kddresearch.org/Courses/CIS636/
Camtasia lectures: Linked from course web page (http://bit.ly/eILaFl) and KSOL

Course Description

This course provides introductory background in computer graphics for graduate and undergraduate students. The first part of the course will cover basic principles of graphics display systems: the modelview transformation, projections, clipping, view normalization, and 3-D graphics data structures. The second part of the course will cover fundamental topics in realistic rendering: shading and illumination, texture and bump mapping, visible surface determination, multipass rendering, computer-generated animation, simple character modeling, and basics of color theory and visualization. The third and final part of the course will survey several current topics of interest, including fractals, ray tracing, particle systems, physically-based modeling, and character modeling.

Course Requirements

Homework: 8 of 10 programming and written assignments – 5 written, 5 programming (**16**%)
Paper reviews: 2 written reviews (1-2 pages) of short (10-15 page) research papers (**4%**)
Labs and class participation: attendance (**2**%), in-class discussion (**4**%), peer review (**2**%), labs (**7%**)
Examinations: two hour exams (10% each, **20%** total), 1 final exam (**25**%)
Computer language(s): C/C++, C#, and Java (any of these permitted for term programming project); *OpenGL*, other graphics libraries and packages (e.g., *Ogre3D*, *Maya 9 aka Maya 2011*) to be taught and used
Project: term programming project for all students (**20**%); additional term paper or project extension option for graduate students and advanced undergraduates

References (to be placed on reserve in K-State CIS Library)

- OpenGL Architecture Review Board, Shreiner, D. & The Khronos OpenGL ARB Working Group (2009). *OpenGL® Programming Guide: The Official Guide to Learning OpenGL®, Versions 3.0 and 3.1, 7th edition.* Reading, MA: Addison-Wesley. ISBN: 0321552628
- Angel, E. (2008). *Interactive Computer Graphics: A Top-Down Approach with OpenGL, 5th edition*. Reading, MA: Addison-Wesley. ISBN: 0321535863 (with *OpenGL: A Primer, 3rd edition*, 2007, ISBN: 0321398114)
- Hearn, D. O. & Baker, M. P. (2003). *Computer Graphics with OpenGL, 3rd edition.* Englewood Cliffs, NJ: Prentice-Hall. ISBN: 0130153907.
- Foley, J. D., VanDam, A., Feiner, S. K., & Hughes, J. F. (1991). *Computer Graphics: Principles and Practice, 2nd Edition in C .* Reading, MA: Addison-Wesley. ISBN: 0201848406
- Orange Book 3e (ISBN: 0321637631), SuperBible *aka* Blue Book 5e (ISBN: 0321712617), formerly Cyan Book

Additional bibliography (excerpted in course notes and handouts)

- Tufte, E. R. (2006). *Beautiful Evidence.* Cheshire, CT: Graphics Press.
- Tufte, E. R. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire, CT: Graphics Press.
- Card, S. K., MacKinlay, J. D., & Schneiderman, B. (1999). *Readings in Information Visualization: Using Vision to Think*. San Francisco, CA: Morgan Kaufmann.
- Barnsley, M. F. (1993). *Fractals Everywhere, 2nd Edition*. Burlington, MA: Academic Press.
- Books on Maya and Ogre 3D – to be announced

Course Calendar and Syllabus

Lecture	Date	Topic	Primary Source(s)
0	Wed 19 Jan 2011	Course Overview	Chapter 1, Eberly 2e
1	**Fri 21 Jan 2011**	**CG Basics: Transformation Matrices; Lab 0**	**Sections (§) 2.1, 2.2**
2	Mon 24 Jan 2011	Viewing 1: Overview, Projections	§ 2.2.3 – 2.2.4, 2.8
3	Wed 26 Jan 2011	Viewing 2: Viewing Transformation	§ 2.3 esp. 2.3.4; FVFH slides
4	Fri 28 Jan 2011	Lab 1a: Flash & OpenGL Basics	Chapters 2, 16[1], Angel *Primer*
5	Mon 31 Jan 2011	Viewing 3: Graphics Pipeline	§ 2.3 esp. 2.3.7; 2.6, 2.7
6	Wed 02 Feb 2011	Scan Conversion 1: Lines, Midpoint Algorithm	§ 2.5.1, 3.1; FVFH slides
7	**Fri 04 Feb 2011**	**Viewing 4: Clipping & Culling; Lab 1b**	**§ 2.3.5, 2.4, 3.1.3**
8	Mon 07 Feb 2011	Scan Conversion 2: Polygons, Clipping Intro	§ 2.4, 2.5 esp. 2.5.4, 3.1.6
9	Wed 09 Feb 2011	Surface Detail 1: Illumination & Shading	§ 2.5, 2.6.1 – 2.6.2, 4.3.2, 20.2
10	**Fri 11 Feb 2011**	**Lab 2a: Direct3D / DirectX Intro**	**§ 2.7, Direct3D handout**
11	Mon 14 Feb 2011	Surface Detail 2: Textures; OpenGL Shading	§ 2.6.3, 20.3 – 20.4, *Primer*
12	Wed 16 Feb 2011	Surface Detail 3: Mappings; OpenGL Textures	§ 20.5 – 20.13
13	**Fri 18 Feb 2011**	**Surface Detail 4: Pixel/Vertex Shad.; Lab 2b**	**§ 3.1**
14	Mon 21 Feb 2011	Surface Detail 5: Direct3D Shading; OGLSL	§ 3.2 – 3.4, Direct3D handout
15	Wed 23 Feb 2011	Demos 1: CGA, Fun; Scene Graphs: State	§ 4.1 – 4.3, **CGA handout**
16	**Fri 25 Feb 2011**	**Lab 3a: Shading & Transparency**	**§ 2.6, 20.1, *Primer***
17	**Mon 28 Feb 2011**	**Animation 1: Basics, Keyframes; HW/Exam**	**§ 5.1 – 5.2**
	Wed 02 Mar 2011	**Exam 1 review; Hour Exam 1 (evening)**	**Chapters 1 – 4, 16, 20**
18	**Fri 04 Mar 2011**	**Scene Graphs: Rendering; Lab 3b: Shader**	**§ 4.4 – 4.7**
19	**Mon 07 Mar 2011**	**Demos 2: SFX; Skinning, Morphing**	**§ 5.3 – 5.5, CGA handout**
20	Wed 09 Mar 2011	Demos 3: Surfaces; B-reps/Volume Graphics	§ 10.4, 12.7, **Mesh handout**
21	**Fri 11 Mar 2011**	**Lab 4a: Animation Basics**	**Flash animation handout**
22	Mon 21 Mar 2011	Animation 2: Rotations; Dynamics, Kinematics	Chapter 17, esp. §17.1 – 17.2
23	Wed 23 Mar 2011	Demos 4: Modeling & Simulation; Rotations	Chapter 10[1], 13[2], §17.3 – 17.5
24	**Fri 25 Mar 2011**	**Collisions 1: axes, OBBs, Lab 4b**	**§2.4.3, 8.1, GL handout**
25	Mon 28 Mar 2011	Spatial Sorting: Binary Space Partitioning	Chapter 6, esp. §6.1
26	**Wed 30 Mar 2011**	**Demos 5: More CGA; Picking; HW/Exam**	**Chapter 7[2]; § 8.4**
27	**Fri 01 Apr 2011**	**Lab 5a: Interaction Handling**	**§ 8.3 – 8.4; 4.2, 5.0, 5.6, 9.1**
28	Mon 04 Apr 2011	Collisions 2: Dynamic, Particle Systems	§ 9.1, particle system handout
	Wed 06 Apr 2011	**Exam 2 review; Hour Exam 2 (evening)**	**Chapters 5 – 6, 7[2] – 8, 12, 17**
29	**Fri 08 Apr 2011**	**Lab 5b: Particle Systems**	**Particle system handout**
30	**Mon 11 Apr 2011**	**Animation 3: Control & IK**	**§ 5.3, CGA handout**
31	Wed 13 Apr 2011	Ray Tracing 1: intersections, ray trees	Chapter 14
32	Fri 15 Apr 2011	Lab 6a: Ray Tracing Basics with POV-Ray	RT handout
33	Mon 18 Apr 2011	Ray Tracing 2: advanced topic survey	Chapter 15, **RT handout**
34	Wed 20 Apr 2011	Visualization 1: Data (Quantities & Evidence)	Tufte handout (1)
35	**Fri 22 Apr 2011**	**Lab 6b: More Ray Tracing**	**RT handout**
36	Mon 25 Apr 2011	Visualization 2: Objects	Tufte handout (2 & 4)
37	Wed 27 Apr 2011	Color Basics; Term Project Prep	**Color handout**
38	Fri 29 Apr 2011	Lab 7: Fractals & Terrain Generation	**Fractals/Terrain handout**
39	**Mon 02 May 2011**	**Visualization 3: Processes; Final Review 1**	Tufte handout (3)
40	**Wed 04 May 2011**	**Project presentations 1; Final Review 2**	**–**
41	Fri 06 May 2011	Project presentations 2	–
		Final Exam 11:50 Tue 11 May 2011	**Ch. 1 – 8, 10 – 15, 17, 20**

Lightly-shaded entries denote the due date of a written problem set; heavily-shaded entries, that of a machine problem (programming assignment); blue-shaded entries, that of a paper review; and the green-shaded entry, that of the term project.

Lab exercises are always due on the day before the next lab.

Green, **blue** and **red** letters denote **exam review**, **exam**, and **exam solution review** dates.

[1] Required for CIS 636 students; optional (refresher as needed) for CIS 736 students.
[2] Required only for CIS 736 students.